MEASUREMENT OF THE EFFECTS OF SOCIO-ECONOMIC VARIABLES ON COLLEGE STUDENT EMPLOYMENT. A TEST OF APPLICABLE UNITED STATES 1970 CENSUS DATA

By

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A DISSERTATION PRESENTED TO THE GRADUATE COUNCIL OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

1975

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March, 1975

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It is the conventional wisdom that socio-economic factors have a major effect on student employment. In our study we attempted to evaluate the significance of this effect. We developed a model which shows the relationship between economic and noneconomic variables and foregone income, and demonstrated the importance of student employment in this relation.

In order to measure the effect of the socio-economic factors on student employment, we utilized the United

States 1970 Census data on undergraduate students. We hypothesized that these factors have an effect on student employment. We divided the test into two parts. At first we tested the significance of the influence of the socio-economic variables on the decision whether or not to work at all. We then tested the significance of these variables on the determination of how much time a student chooses to spend at work.

We found sufficient evidence to reject the two hypotheses. That is, we found sufficient statistical evidence to conclude that the effect of socio-economic variables on student employment is of little or no significance.

CHAPTER I

EDUCATION AND HUMAN CAPITAL
A REVIEW OF THE LITERATURE

Introduction

The study of human capital did not receive much attention in the economic literature until recently. Kiker [1971], in his historical survey of the human capital concept, indicated that there were mainly two methods which had been developed to estimate the economic value of humans: the cost-of-production and the capitalized-earnings procedures. Since Kiker's study was written in 1966 it did not include the more recent and significant developments with respect to the human capital concept. In this chapter we present a survey of some of those recent works.

Although economists associate human capital with formal education, on-the-job training, self study, health, and more, we shall concentrate in the following survey only on formal education, and especially on higher education.

A person who acquires education can be regarded in two ways--as an investor or consumer. Though most economists regard education mainly as an investment,[1] that is, the student attempts to maximize the rate of return resulting from educational expenditures, some have recognized the consumption component of education, that is, the student attempts to maximize the direct immediate utility from education.

Education As An Investment

Mainly, studies on investment in human capital must estimate the costs, the benefits, and the resulting relative rate of return.

One hypothesis that is common to most such studies is that a person treats investment in human capital in the same way as investment in other forms of capital. If the person is a profit maximizer, he will invest where he expects the highest rate of return. Therefore, if the marginal rate of return from investment in human capital is greater than the market interest rate, the

[1]Kiker suggests that this is due to the difficulties of separating investment and consumption and other unique attributes of human capital that make the cost-of-production approach useless.

investment is deemed to be profitable and the person will invest in human capital.

One of the first and most important studies which tried to estimate the rate of return from human capital was conducted by Becker [1964]. His model is as follows.

Let $x_1, x_2, \ldots, x_n$ be the stream of one's earnings during n periods. Let $y_1, y_2, \ldots, y_n$ be the stream of earnings if one invests in human capital in n periods. Let V denote the present value of the future earnings, then the gain from the investment is the difference between the two present values. In symbols:

$$D = V(Y) - V(X) = \sum_{j=1}^{n} \frac{(y_j - x_j)}{(1 + i)^j} \qquad (1)$$

where i is the market interest rate.

If D is greater than zero, then it is profitable to invest in human capital.

The equation (1) can be written in a different manner. Let C be the cost of the investment and r be the rate of return from the investment. Then,

$$C = \sum_{j=1}^{n} \frac{(y_j - x_j)}{(1 + r)^j}. \qquad (2)$$

From equation (2), one can find r if x, y, and c are known. Hence, if $r \geq i$, then the investment is profitable. It is obvious that equations (1) and (2) can be applied to any investment and are not necessarily restricted to human capital.

Hanoch [1967] estimated the internal rate of return from schooling. His method was similar to that used by Becker. He assumed that earnings are a function of school level achieved (number of years in school) and some other factors such as ability, socio-economic background, etc. Let Y be the flow of earnings, s be the school level, and z be the vector of the other factors which influence the earnings.

The effect of one year of school on earnings, everything else being fixed, is given by the formula.

$$D_t(S, Z) = Y_t(S, Z) - Y_t[(S - 1), Z]. \qquad (3)$$

Let R be the internal rate of return. Then

$$0 = \sum_{t=0}^{n} \frac{D_t(S, Z)}{(1 + R)^t} \qquad (4)$$

The difference between Hanock's study and Becker's is that Hanock tried to estimate the "internal" rate of

return rather than the "general" rate of return from investment.[2] The resemblance between equations (1) and (2) and equations (3) and (4) is obvious. If, for example, a in equation (3) is equal to one, then we can write $Y_t(z) = x$, and the equation becomes like equation (1), except that in equation (1) there are present values of the earnings.

Ben Porath [1970] used a slightly different approach, but his equations are essentially the same as the previous studies. He tried to show why a person tends to concentrate his investment in human capital in the first part of his lifetime, that is, when he is young. His model assumes that a person expects to live T years and that the opportunity costs of the investment increase as more capital is acquired. Also, he assumed that the person maximizes his present value of his expected earnings.

Let Y be the flow of earnings and I be the cost of the investment, then the present value is:

[2] Hanoch tried to find the "contribution" of each year in school to one's earnings, while Becker attempted to find the "contribution" of education as a whole. In other words, "n" in equation (1) is lifetime, and "n" in equation (4) is school time.

$$W(t) = \int_{t}^{T_e} [-r(Z-t)] \, [Y(z) - I(z)] \, dz, \qquad (5)$$

where z is a point in the life cycle.

Equation (5) can be written in discrete form, and it will be similar to equation (2).

Ben Porath's approach is a little different from the previous studies. According to him, a person produces human capital rather than invests. He uses the following production function:

$$Q(t) = F[S(t)K(t), D(t)], \qquad (6)$$

where Q is the quantity produced, S is the proportion of the day devoted to school, K is some capital index, and D is the vector of the other inputs in the production function.

The controversy among economists is on how to measure the parameters. There are two parameters that cause most of the trouble, the costs and the benefits. The rate of return is also not subject to total consensus, but since it is a function of the previous two, we shall concentrate first on the problem of estimating the costs and the benefits.

Since the investor chooses among some economic alternatives, it is necessary to express human capital in economic terms. The returns are of two kinds, pecuniary, that is, higher wages and salaries, and nonpecuniary, for example, social status and interest in the job. The costs are also of two kinds, direct costs, such as tuition and books, and indirect costs, that is, income foregone.

It is assumed that one who invests in human capital expects to get a higher income than before the investment. The difference is in the pecuniary return. One of the problems which has not been reconciled yet is that of separating the factors which cause a higher income. Economists have realized that higher income is a result not only of education but that other factors are also involved. One, for example, is the screening factor (Denisre [1972]), but, apparently, it is difficult to measure. Another factor, which has received considerable attention, is ability. However, there are different definitions of ability, the most common of which is IQ, or some alleged indicators such as SAT or GRE scores and grade-point-averages. Some examples of studies using such indicators are:

1. Ashenfelter and Mooney [1968] took the mathematical aptitude

test as an indicator of ability and found that its effect on the difference in earnings is small.

2. Weisbrod and Karpoff [1968] conducted a study on employees at AT&T and found that ability had a large influence on earnings. They used "rank in class" as the indicator of ability.

3. Griliches and Mason [1972] did a study on veterans and found that ability had little influence on earnings. Their indicator of ability was the Armed Forces Qualification Test (AFQT), which is similar to the standard civilian IQ tests.

4. Chamberlain and Griliches [1974] found a high correlation between ability and earnings, but their data are from a study that was done in 1932.

5. Weiss [1972] used GRE scores and average grades as an indication of ability and assumed a high connection.[3]

6. Hause [1972] used IQ scores and found a moderate connection between ability and earnings.

From the above works (only some of which are cited), one cannot say anything firm about the relationship between ability and earnings, but perhaps there is some

[3]Weiss assumed a high correlation without testing it. In his article he did not give any justification for that assumption.

correlation between the two. It should be noted that psychologists have found a high correlation among all the academic ability tests. Hence, it is not very important for our purpose which test one chooses to use.

While the difference in earnings may represent the pecuniary returns from the investment in human capital, there are also nonpecuniary returns. The fact that persons study subjects that may not offer high money incomes, such as art and literature, for example, suggests that people may expect to get more than just a higher salary. But this aspect is difficult to measure and has not been the subject of empirical studies in the economic literature.

The cost of investment is divided into two parts, direct costs and indirect costs. The direct costs include tuition, fees, outlays on books and supplies, and other expenses like food, clothes, and transportation. It seems that, empirically, it is relatively easy to measure direct costs, but there are some conceptual problems. For instance, if the student gets discount prices on food, room, and supplies, should we regard those prices as costs or the market prices as costs? Another example is how much of the expenses on food are for pleasurable consumption and how much may be considered

investment (needed to maintain life)? Despite such issues, it seems that the direct costs are not a source of major controversy among economists. The controversy is over indirect cost, or foregone income.

There are two kinds of foregone income. The first kind results when a student does not work at all; he foregoes some income which he would have earned if he had gone to work instead of to school. The other kind results from the low wage rates students earn because they work only part-time with high levels of competition for jobs, especially in a university town.

Foregone Income and Students' Work

Surprisingly, until about 1960, economists were not sufficiently concerned about foregone income to include it as a cost in education studies. In 1960 Schultz tried to estimate the foregone income by students (Schultz [1960]). He assumed that school time is measured by the value of the work of those people of the same age, sex, race, and other characteristics, who work and are not in school. He also assumed, apparently quite arbitrarily, that students work 11 weeks a year, that is, they work only in the summer. He estimated that for 1949, the foregone income was about half of the cost of the invest-

ment in human capital.

Schultz's article was criticized by Blitz [1961] and later by himself.* Blitz said that the results Schultz found were biased downwards because of the incorrect figures which were taken from the Census, and that he also did not adjust the figures for unemployment rate. Schultz, himself, in a draft to Mushkin [1961], admitted that his assumption that students work only in the summer was not too reasonable.

Becker [1964] assumed that students work one quarter a year. The rationale behind this assumption was that the figures for labor force participation were found to be .236.

Ben Porath [1970] suggested that indirect costs should be measured by the explicit formula $w\hat{S}K$, where w indicates wage rate and $\hat{S}K$ is the input in the production function [equation (6) above], that is, the amount of human capital used to produce more human capital. Ben Porath did not assume anything about the size of w and S, nor did he measure it.

*In 1971, in his book Investment in Human Capital, he estimated the foregone income for years 100-1956 using the same method as in his 1960 article. The results were that the foregone income increase for 1956 was about 60 percent of the total cost.

Students' work is a very important factor in determining the indirect costs. The more the student works, the less is his income foregone. The approach for estimation of the income foregone that Schultz, Becker, Ben Porath, and others used is based on the assumption that the sum of the time devoted to work and schooling is fixed. In other words, if we increase the schooling by one hour, we should decrease the work time by one hour. This approach also implies that in equilibrium the marginal rate of return from school is equal to the wage rate, and both are equal to the marginal utility of leisure. Although they did not assume it explicitly, this is what their method implies.

Parsons [1974] tried to show that his assumption is incorrect. He assumed that a person who goes to school consumes more leisure than a person who does not go to school. In other words, the time devoted to work and to school is not fixed. He found that a student spends more time on schooling (classwork and homework) than a non-student spends working. His data are based on a survey of high school students. Although the results might be different for college students, it could be expected that a survey would show similar results.

The above studies about income foregone are more

theoretical than empirical. In other words, none of the studies attempted to estimate how many hours per day and how many days per week students actually work. However, data on students' work are available.

Monthly Labor Review published several surveys in different years on students' work. The labor force participation rate was, on average, 45 percent for men and 40 percent for women in the last six years. The sources did not separate those students who work full-time and those who work part-time. But the rate is still high, considering that the surveys were conducted in October--the beginning of the school year.

Rosenfeld and Gover [1972] published a survey that was done in March 1971 for the year 1970. In this survey, they classified those who worked full-time and those who worked part-time. They found that during 1970, 66.5 percent of the male students aged 16-21 worked either full-time or part-time, and that 53.8 percent of the female students aged 16-21 worked.

The following table shows the classifications among those who worked at all during 1970. These figures are in percentages. From this table, we conclude that the percentage of students who worked full-time at least one quarter of the year is very low, relative to Schultz,

	Men	Women
Full-time	36.9	27.0
1-13 weeks	25.4	19.0
14-26 weeks	7.2	4.2
27-49 weeks	2.2	2.4
50-52 weeks	2.2	1.4
Part-time	63.1	73.0
1-13 weeks	23.9	28.9
14-26 weeks	11.7	17.6
27-49 weeks	11.5	14.0
50-52 weeks	16.0	12.5

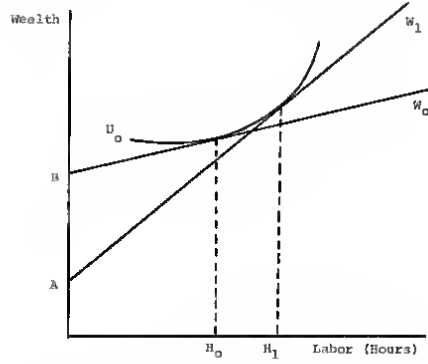
Blitz, Becker, and others, who assumed that all students worked full-time one quarter of the year, which is equivalent to 25 percent of the students working full-time all year long. According to Rosenfeld and Gover, this assumption is biased upward. This implies that the income foregone estimated by Schultz, Becker, and others is smaller than it is in reality. But it must be remembered that these figures correspond to people 16-21 years old, and, therefore, any conclusion about college students based on these figures is somewhat speculative.

Education As Consumption

The studies presented in this section all emphasize the personal utility which flows from education.

The study by Lindsay [1971] combined the investment and the consumption components and analyzed the invest-

ment using utility. He argued that an investor will invest only if the investment leaves him in a better position, that is, on a higher welfare function. In the case of human capital, higher wages make leisure time relatively more expensive. Hence, there is a "substitution effect" and an "income effect," since there is a change in the price ratio. Graphically, this can be depicted as follows:



W_0 is the wage rate before the investment, AB is the actual cost of the investment, and W_1 is the wage rate

after investment. If the investor will increase his working hours from H_0 to H_1, as some empirical studies show, then the individual will not be better off.

Corazzini, Duggan and Grabowski [1972] tried to determine the factors which influence the demand for education by connecting both the investment and consumption components. In their demand function, they inserted variables such as expected increase in earnings as well as consumption benefits from education, direct costs, discount rates, opportunity costs, and rationing by schools.

Campbell and Siegel [1967] also estimated a demand function which includes goods and leisure.[5] The individual tries to maximize that function, subject to the following constraint:

$$A_0 + \sum_{i=1}^{t} (1 + r)^{1-t} [W_1 (H - L - S_i)]$$

$$- \sum_{i=1}^{t} (1 + r)^{1-t} (PX_i + CS_i) \geq 0,$$

where A_0 is the initial assets level, r is the interest

[5]The utility function is $U = U_1(X_1, \ldots, X_i, L)$, where X_i are goods and L is leisure.

rate; W is the wage rate; H is 24 hours; L is leisure; S is schooling time; P is the price index; C is the direct cost of school; X is goods; and i is the periods. Thus, the first summation is the earnings during school and the second summation is the direct cost of education, all in terms of present value.

Summary

In this chapter, some of the recent studies on human capital were summarized. Two approaches were discussed--investment and consumption, but special attention was given to the investment approach. The studies demonstrated the problems of defining and measuring the parameters. However, these studies assumed that students who attend college work only a few weeks a year, mainly during the breaks. The empirical studies by Becker, Schultz, Blitz, and others estimated foregone income, given that students work only one quarter of the year. Except for short and partial studies conducted by the Bureau of Labor Statistics, there has not been any serious attempt to measure how much students actually work during the school year and what are the factors which determine this. Our study will attempt to remedy this deficiency.

CHAPTER II

A THEORETICAL MODEL RELATING STUDENT EMPLOYMENT TO SOCIO-ECONOMIC AND DEMOGRAPHIC VARIABLES

Introduction

The decision to continue one's education, either immediately after high school or later in life, is based on the expectations of receiving immediate and long-run benefits, even though there will also be some immediate costs. If the person is economically rational, we may assume that the benefits he or she expects from education exceed the anticipated costs. A question that may be asked, therefore, is: Why should we pay special attention to investment in education? Why not treat it like any ordinary investment in capital goods? The answer is that human capital has different characteristics than nonhuman capital. Hence, the criteria for making a decision to invest in education are different from the criteria to invest in nonhuman capital.

Some of the particular characteristics of human capital are:

1. Human capital is not a negotiable asset. That is, one cannot separate it from the person who owns and possesses it. This implies several other characteristics.

2. Human capital has no market price as commonly perceived, since it cannot readily be sold nor exchanged with other goods.

3. It is extremely difficult to distinguish between the consumption component and investment component of human capital, for example, how much of the food one buys is to maintain life (investment) and how much to enjoy it (consumption).

4. Human capital involves skills that sometimes cannot be used simultaneously, since they cannot be separated. For instance, a person who studied history and physics and then is employed as a history teacher is not very likely to use his physics training. This is not so in the case of nonhuman capital.

5. Human capital cannot be acquired by everyone. There are some skills and knowledge which cannot be learned, even if there are no financial constraints.

6. The cost and the benefits of increasing human capital greatly depend upon the personal characteristics of the individual. An able student, for example, can learn more quickly than the less able student, and, hence, the direct money costs are less.

7. The investment in human capital

is "lumpy"; that is, the units are very large. For instance, a medical student cannot practice his craft until he completes at least four years in school and training. The marginal aspect of the investment, therefore, loses much of its meaning.

8 Often the one who actually invests is not the one who directly acquires the human capital, nor the one who receives the benefits. In many cases the parents are those who make the investment decision and pay a large share of the costs, while their child is the one who obtains the capital and receives most of the benefits.

Most of the works written on rate of return from investment in human capital ignored some of the above specific characteristics. Obviously, if it is assumed that human capital is like any other capital asset, then no special theory is needed. In the previous chapter some of the main works on the subject were discussed and their shortcomings were pointed out. By neglecting some of the specific attributes of human capital, biased results were obtained which could not be fully explained.

Another point which causes some difficulties in analyzing investment in human capital is the fact that it involves many noneconomic factors. It is very common to assume that the decision to invest in assets is mainly

economic, that is, the investment yields the highest expected rate of return and maximum benefits. In investment in education, factors such as socio-economic background, personal preference and special private interests are involved, and in many instances the economic decision is not even the dominant one.

We shall attempt here to deal with some of the economic aspects of investment in human capital, avoiding the special noneconomic attributes of human capital but not disregarding these completely. Apparently, there is a connection between the costs, the benefits, and the special characteristics of the investor, that is, his ability, social and economic background, and other personal attributes

The Description of the Model

The following model takes into account the economic and noneconomic factors in investment in human capital and shows the interrelationships between them.

Consider a student who is enrolled in a college, studies a particular subject and possesses a given degree of ability and talent. Also assume that the student must spend a certain amount of hours in class and out of class

in order to earn an academic degree.[1] The relation between indirect cost, the benefits, and the ability can be depicted graphically as follows.

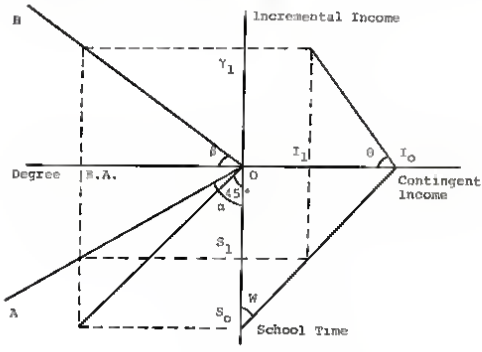


Figure 1

The incremental income is the additional earnings received by one who has a baccalaureate degree. In other words, this is the difference between the income one would

[1] This degree refers to the baccalaureate, although the model is valid for any other degree.

have received without the degree. This difference is the pecuniary benefit from education. The values on the axis are the present value of the incremental income.[2] In Figure 1, Y_1 represents the present value of incremental income for a student who has a bachelor's degree. On the right axis, I, we measure contingent income, that is, the income the student would receive if he works during school time. The amount is the present value of income received during his four years in college.[3] In Figure 1, the student worked part-time and received $0-I_1$ income. The rest (I_1-I_0) is the income he gave up.

We assume a certain amount of hours an average student spends in studying. This amount is S_0 on the axis of school time.[4] In Figure 1 the student spent less time studying than an average student, only S_1 hours. During the rest of the time $(S_1 - S_0)$, the student opted to work.

---

[2] Symbolically, it is $V = \sum_{t=1}^{T} \frac{R_t}{(1+r)^t}$, where V is present value, R_t is the incremental income in year t, and r is the rate of interest assuming the student will work T years.

[3] If the student works every year, then we calculate the present value of his income for four years. If he works only part of this period, we can calculate the value for those years only.

[4] It is arbitrary to relate S_0 to an average student. It can, arbitrarily, be any amount which is convenient to the study.

The last axis, the degree, is the same as the "school time" axis. The units are the hours the student spends in school in order to get a bachelor's degree. Hence, BA is equal to S_o.

There are four parameters in the model. The first one, W, is the average wage rate the student receives when he works.[5] The rate is wage per hour. Of course, we could calculate the nominal wage rate for each hour, but if we do so, the slope would be different at every point. However, this complication would not change the analysis and, hence, it is unnecessary.

The parameter a is equal to the ratio S_o/S. It is the ratio between the average time needed to earn a baccalaureate to the actual time spent to achieve this degree. If $a > 1$, then the student earns a degree in less time than the average student; if $a < 1$, he spends more time. The question now is what are the factors that determine the size of a? These are, in fact, all the factors that influence the completion of a degree--genetic and environmental. These factors include ability, talent, family income, parents' education, quality of secondary education, and other socio-economic and demographic

[5]It is also the wage rate he could receive even if he did not actually work, i.e., it is the contingent wage rate.

variables. For simplicity we shall use the term "ability" to represent all these factors. Since these factors are measured in different units, a is some composite index that represents all of them. The graph shows that a student with a given a needs S_1 time in school to earn the degree.

The index and how to measure it needs more explanation. In a theoretical work such as this, it is sufficient to speak of some composite index, but in empirical studies, this term would have to be defined more explicitly. One way to do it is to assume that the hypothetical "average" student is characterized by "average" IQ, "average" family income, "average" academic performance, etc. Arbitrarily we assume that for this "average" student, the index is equal to 100 (the slope is 45 degrees).

The third parameter, β, is the "productivity" of the degree. The line B represents a production function where time spent in school is input and incremental income is the output. β is the average rate of return. It is not necessary that B be a straight line. If we relax the assumption that education is "lumpy," then there is meaning to a marginal rate of return from each unit, such as one year, and certainly β can be different

for each point on the line.

The "production function" is exogenous to the system, that is, a student cannot influence or change the productivity of the school time (the degree). If he has a BA, the beginning salary is given by the market. Personal characteristics have influence only in the long run. It must be noted that although the individual has no influence on the incremental income in the short run, he might receive a different income which has some relation to his personal attributes. For instance, a female may anticipate a lower salary than a male even if she holds the same degree, is the same age, etc. The same is probably true for whites and nonwhites. Therefore, we can find some correlation between the two parameters, β and α. There might also be some relation between α and the wage rate, W. These three parameters are <u>given</u> in the model, and the student cannot do much to change them. But they determine the size of the fourth parameter, θ.

θ is equal to the ratio between incremental income and foregone income. In other words, this is the ratio of the benefits from education to the indirect cost of it. The size of θ may provide some indication of the profitability of the investment in human capital. A profitable investment is when the present value of the

returns exceeds the cost of this investment. Therefore, if $\theta > 1$, the investment may be profitable. If $\theta < 1$, the investment is not profitable. It must be recalled that indirect cost is only part of the total cost of education, therefore, θ cannot be sufficient indication. However, if direct costs are subtracted from the present value of the returns before calculating θ, then θ is the measure of profitability.

Obviously, the higher is θ the more profitable is the investment.[6] We can see in Figure 1 that θ is a function of foregone income, which depends on the size of α and the level of wage rate.[7] But the ratio θ depends also on the size of incremental income, which is a function of β. Here we see how all the parameters are interrelated.

Before concluding this section we would like to clarify how our model differs from other models.

1. We showed earlier that students' work is significant when we deal with foregone income. This point was noted in some previous studies.

[6] This is true only if Y is the same for different values of θ. Otherwise one should maximize the present value rather than the ratio θ.

[7] Foregone income is equal to the time spent in school times wage rate, wS_1, and the size of S_1 determines the size of α.

on human capital, and some even estimated the amount. In this study, however, the parameter is the option and the capability to work, rather than the actual work, and, hence, indirect costs are not a given amount but can vary in a certain range depending upon the individual.

2. The parameter we called "ability," which includes many economic and noneconomic variables, has been used in many previous studies on human capital. In those studies, regardless of the "units of ability" used, economists related ability to the benefits from education.

In this model the variables which are included in "ability" might have influence on the future income, but we attempt to show that those variables have correlation with the time devoted to schooling and, through the feasability to work, with indirect costs. Thus, the correlation is between ability and costs, rather than between ability and return.

3. Most of the studies on investment in human capital compare this investment with investments in capital assets. In other words, those studies deal with students versus nonstudents. Our study deals with students only and discusses the differences among them regarding the returns and costs of investment in education.

The Relation Between the Ability and the Profitability

In the previous section we showed in Figure 1 that the higher is α, the higher is θ, *ceteris paribus*. However, there are two special cases that are not demonstrated in Figure 1. The first case is when a student has α which is less than one, that is, he has to spend more time in school than an "average student." In Figure 1, we see that foregone income of the "average" student is $0\text{-}I_0$, which is equal to wS_0. If a student has $\alpha < 1$, then his time spent in school, S_2, is greater than wS_0. His profitability ratio, θ, is, of course, smaller than that of an "average" student.

The second case is when a student for one reason or another chooses to spend more than four years to complete his degree. This will not show up on the "school time" axis because the total amount of hours he actually spends at school work is the same but is only stretched out over a longer time. But it might affect the present value of his future income, since he enters the job market later. However, it should be noted that this behavior may not affect his foregone income, since the longer period in school may be due to his choosing to work more while he is a student.

The Relation Between the Wage Rate and the Profitability

Let us assume two students who experience different wage rates, ceteris paribus. A possible example may be found in sexual discrimination. Males often receive higher wage rates than do females. Another instance could be discriminatory wage rates between whites and nonwhites. The following diagram indicates how this affects the profitability of the investment, that is, the size of θ.

In this figure we see that the higher the wage rate, the larger the foregone income, and the higher the foregone income, the smaller the profitability ratio. Hence, the higher the wage rate, the smaller the profitability ratio. Such a conclusion, though true mathematically and in economics, could be misinterpreted. According to the results, one could argue that in order to increase the rate of return, one should decrease the wage rate. For example, if the wage rate is close to zero, the rate of return is close to infinity. The economic interpretation is that zero wage rate means zero opportunity costs and, therefore, a very high rate of return. This fact may explain why students are more likely to go to school when they have no employment opportunities. For

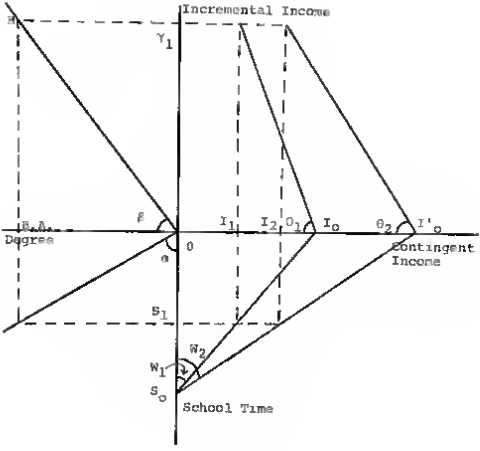


Figure 2

those students, going to school is the best decision from an economic point of view.

The misinterpretation which is possible is that one might find justification for discrimination in wages. The reason that there is not such a justification is be-

cause discrimination may cause a reduction in welfare. An interesting product of this model is the comparison of relative foregone income rather than absolute foregone income. By relative, or proportional, foregone income is meant the ratio between the foregone income to maximum contingent income--$(I_1 - I_o)/(0 - I_o)$ and $(I_2 - I'_o)/(0 - I'_o)$ in Figure 2. It can be proved that these two ratios are equal.[6] In other words, regardless of discrimination in wage rates, the relative sacrifice each student makes by losing income is equal.

Conclusion

In the first section of this chapter we indicated the unique characteristics of human capital, how it differs from other capital goods, and why it needs a special theory. The main point that we were trying to make was that investment in education involves many noneconomic factors.

In the later sections we described a model that

[6] The proof is as follows:

$\frac{I_1 - I_o}{0 - I_o} = \frac{0 - S_1}{0 - S_o}$; also, $\frac{I_2 - I'_o}{0 - I'_o} = \frac{0 - S_1}{0 - S_o}$,

which implies that $\frac{I_1 - I_o}{0 - I_o} = \frac{I_2 - I'_o}{0 - I'_o}$ Q.E.D.

shows the interrelations among the economic and non-economic factors. Although the model is simple, it shows the general and main relationships. We showed that personal characteristics have a great influence on foregone income. We showed that able students are likely to forego less income than students who are less able. Also, we showed that wage discrimination has no effect on foregone income if we assume ceteris paribus. We showed that, relatively, the income foregone is the same.

In the next chapter we shall test this model empirically and concentrate on the parameter s_i. In other words, we shall attempt to evaluate some of the factors which are presumed to influence the student's decision to seek outside employment. Concurrently, this will help to determine the time a student chooses to spend in school.

CHAPTER III

A TEST OF THE SIGNIFICANCE OF U. S CENSUS RELATING STUDENT EMPLOYMENT TO SOCIO-ECONOMIC AND DEMOGRAPHIC VARIABLES

Introduction

A widely accepted assumption in the relevant literature is that indirect costs constitute a significant share of the total cost of education. In the last chapter we showed that the size of indirect costs is a function of the amount of work a person carried on during the period enrolled in college. This function is simple and direct; the more a student works the less income is foregone and, hence, the less is the indirect cost. Since students' work is crucial in calculating the foregone income, we need to examine the amount of student work and the factors that determine and influence that amount.

In the conventional wisdom, there is the belief that socio-economic and demographic characteristics play the dominant role in determining the amount of student work. Among these characteristics are parent contribution

(that is, income received from parents), sex, marital status, race, age, school level, and place of residency. Our purpose is to test this hypothesis--namely, that the socio-economic and demographic factors have a significant effect on the amount of student work--and we shall attempt to validate this by estimating the size of these relationships.

The data used to test the above hypothesis were derived from a one-in-a-thousand sample of the 1970 U. S. Census. The general characteristics of the data appear in Table A-1 in the appendix. The specific variables used in the tests are: parent contribution, sex, year in college, marital status,[1] and weeks of work. The last variable is the dependent variable and the others are the independent variables.

The two questions to be answered are which students want to work and the amount of time worked. Although these questions are connected, we preferred to answer them separately.

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[1]There was no direct information on marital status which could match with the other variables. There was information on singles only. Hence, the tables and the tests are for two categories: "singles" and "all." The difference is not precisely the "married students," since we cannot find out when the students were married. Nevertheless, we can speculate that the difference between those two categories is due mostly to married students.

Before answering those questions, an important comment must be made. The variables age, race, and place of birth were not included in our tests for the following reasons:

1. There is a very high correlation between age and year in college.
2. The number of observations for nonwhite students is too small to be statistically significant.
3. The place of birth had no effect on other variables, and we can regard the whole nation as homogeneous.

Which Students Work

In order to determine which students work, a close examination of the data was necessary. Table 1 summarizes the results of such examination. The data below refer to percentages of students who work. For instance, the "cell" in row (4) and column (3) refers to single freshman females with parent contributions between $1,500 and $3,000; 56.3 percent of such students went to work.

A Chi-Square test was applied to measure the degree of association between work and parent income when other variables are held constant. The following table shows the coefficients of contingency and their significance

TABLE 1

PERCENT OF STUDENTS WHO WORKED, BY PARENT CONTRIBUTION, SEX, MARITAL STATUS, AND YEAR IN COLLEGE

Year in College	Sex	Marital Status		No Contribution (1)	$1 to $1,500 (2)	$1,500 to $3,800 (3)	$3,800 to $6,300 (4)
1st	M	All	1	96.0	94.5	95.7	85.1
		S	2	96.2	85.7	85.7	73.7
	F	All	3	91.8	87.5	52.0	88.9
		S	4	92.3	72.7	56.3	88.2
2nd	M	All	5	92.4	91.4	87.3	95.5
		S	6	94.4	70.0	75.0	88.9
	F	All	7	82.4	78.6	68.8	89.3
		S	8	90.7	72.7	55.6	90.9
3rd	M	All	9	89.2	86.2	87.5	91.3
		S	10	89.6	90.0	81.3	88.2
	F	All	11	92.1	69.0	84.6	94.1
		S	12	96.6	81.3	83.3	(100)
4th	M	All	13	92.9	(100)	89.3	96.3
		S	14	92.0	(100)	80.0	(50)
	F	All	15	91.4	77.8	(100)	83.5
		S	16	93.3	75.0	(100)	80.0
Total		All	17	90.9	88.1	83.5	90.7
Total		S	18	93.2	80.4	75.2	83.5

TABLE 1 - EXTENDED

$6,300 to $9,000 (5)	$9,000 to $11,500 (6)	$11,500 to $15,000 (7)	$15,000 to $20,000 (8)	$20,000 to $50,000 (9)	Total (10)
83.9	83.9	88.6	91.6	92.0	90.2
77.8	82.6	89.5	90.7	91.3	87.4
67.4	80.0	85.2	82.9	80.4	78.8
75.5	77.8	84.0	83.8	81.5	80.8
85.4	82.9	79.5	87.5	87.1	88.5
73.9	82.9	77.8	88.5	84.8	85.0
73.3	83.8	80.6	79.4	75.0	79.3
81.3	84.6	84.6	83.3	80.0	83.2
88.9	76.7	92.3	89.3	92.6	88.0
88.2	75.0	92.0	88.0	93.1	88.0
59.4	77.8	88.0	73.5	63.2	76.7
64.7	83.3	90.0	72.0	68.3	79.9
90.0	(100)	66.7	(100)	92.9	92.6
83.3	(100)	72.7	90.9	91.7	88.6
73.7	88.2	85.7	83.3	78.6	85.7
(50)	(100)	(100)	(100)	83.3	89.1
77.7	82.8	85.1	85.9	83.0	85.9
76.3	82.1	86.0	86.5	84.3	85.1

Nota: The parentheses in the last four rows indicate that the number of cases in the sample in each cell was less than 3.

Source: Raw data from the 1970 Census.

levels.[2]

TABLE 1a

THE X^2 VALUES AND THEIR SIGNIFICANCE LEVELS

Year in College	Sex	"All" Coefficient	"All" Significance	Single Coefficient	Single Significance
1st	Male	.155	.029	.191	.011
	Female	.229	.018	.191	.221
2nd	Male	.144	.251	.219	.043
	Female	.139	.690	.201	.405
3rd	Male	.115	717	.148	.713
	Female	.278	.007	.279	.058

Source: Calculated from Table 1.

The coefficient of contingency is an indicator for measuring dependency between two variables. When the coefficient is equal to 1, the two variables (in our case, work and parent contribution) are dependent. If the coefficient is equal to zero, then the two variables are not dependent. The significance level shows the probability that such a coefficient is different from zero. For example, for "all" sophomore females, we see that the coefficient is different from zero with only 31

[2]The number of observations in the fourth year in college was too small and, therefore, the Chi-Square test is meaningless.

percent probability. Hence, we can conclude, with 69 percent probability, that work and parent contribution are independent.

What is important to note from the above table is the absence of significance in the measured relationships between student employment and parent contribution. Only for junior year females does the significance level exceed 99 percent. But the coefficient in that case is still very low--only 27.8 percent. For all other classifications we can conclude that the two variables, parent contribution and "work," are independent (with 99 percent probability).

Similarly, if we look at column (10) in Table 1 and compare the rows such as (1), (5), (9), and (13)--that is, "all" males--we can conclude that neither sex nor year in college has much influence on whether or not a student works. But if we compare the "all" and "single" cohorts, we observe that in small and medium parent contribution cases, there are some differences which are of interest. For instance, in the second class of parent contribution, $1-1,500, we observe that during their freshman and sophomore years, the "single" students work less than the "all" students, but in their junior year the "single" students work more. This is true for males and females. In the

category of "no contribution" there is almost no difference among females, while in the remaining columns there are differences among the males which are larger than among females. In large contribution categories there is little difference for either sex. Consequently, we can conclude as follows.

1. Parent contribution, sex, and year in college do not exhibit any significant influence on whether or not a student goes to work.

2. Among those who do not receive money from parents there are more single females who work than married ones, while among males there is not much difference between the single and married status.

3. In small and medium parent contribution groups more married males work than single males. Among the females there is not much difference.

4. In the large parent contribution groups marital status does not have any influence.

5. As a whole, regardless of the different categories, marital status has no significant influence on whether or not to work.

How Much Do Students Work?

The information acquired in the previous section an-

abias us to see which students worked. The question now is, among those who work during the school period, how many weeks do they work per year? Table 2 shows the amount of weeks the students in each category worked. Each line shows the distribution of students among the different categories.[3] For example, among all the senior single males, 23.7 percent worked between 40 and 52 weeks per year. Since parent income was not held constant, any conclusions based on the above information must be subject to qualification.

Table 3 "combines" the previous tables and holds all the independent variables constant. The mean number of weeks worked was calculated only for those who worked at least one week.[4]

One may observe that students with no contribution worked more than students with parent contributions of over $15,000. But the shape of the distribution is not at all obvious, and a careful examination shows no particular pattern in any of the rows.

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[3]Note that column (1) in Table 2 is equal to 100--column (10) in Table 1.

[4]The values were found by interpolation assuming a uniform distribution in each category.

TABLE 2

PERCENT OF STUDENTS WORKED,
BY WEEKS, SEX, MARITAL STATUS, AND YEAR IN COLLEGE

Year in College	Sex	Marital Status		Number of Weeks Worked: Did Not Work (1)	1-13 (2)	14-26 (3)	27-39 (4)	40-52 (5)	Total (6)
1st	M	All	1	9.8	24.7	16.3	8.5	40.7	100
		S	2	12.6	31.0	18.5	8.4	29.4	100
	F	All	3	21.2	39.4	14.9	8.7	24.2	100
		S	4	19.2	34.5	15.3	8.2	22.8	100
2nd	M	All	5	11.1	23.1	17.5	8.9	39.4	100
		S	6	15.0	31.0	22.3	7.5	24.1	100
	F	All	7	20.4	28.4	14.4	10.2	26.3	100
		S	8	16.8	34.0	15.2	9.1	24.9	100
3rd	M	All	9	12.0	24.8	18.0	9.3	36.0	100
		S	10	12.0	32.0	21.6	8.3	26.1	100
	F	All	11	23.3	24.1	18.6	11.1	22.9	100
		S	12	20.1	27.9	19.6	9.5	22.9	100
4th	M	All	13	7.4	19.1	16.7	16.7	40.0	100
		S	14	11.4	26.3	23.7	14.9	23.7	100
	F	All	15	14.3	13.5	15.8	15.0	41.4	100
		S	16	10.9	23.4	14.1	10.9	40.6	100
Total		All	17	14.1	24.5	16.6	10.0	34.7	100
Total		S	18	14.9	31.1	19.0	8.9	26.1	100

Source: See Table 1.

TABLE 3

AVERAGE NUMBER OF WEEKS WORKED, BY PARENT CONTRIBUTION, SEX, MARITAL STATUS, AND YEAR IN COLLEGE (EXCLUDING THOSE WHO DID NOT WORK)

Year in College	Sex	Marital Status		No Contribution (1)	$1 to $1,500 (2)	$1,500 to $3,800 (3)	$3,800 to $6,300 (4)
1st	M	All	1	28	28	29	26
		S	2	22	17	13	16
	F	All	3	26	23	20	18
		S	4	25	21	8	13
2nd	M	All	5	25	26	28	30
		S	6	20	15	16	21
	F	All	7	23	15	18	26
		S	8	22	11	19	17
3rd	M	All	9	23	19	25	28
		S	10	19	12	19	23
	F	All	11	27	13	19	25
		S	12	26	10	18	29
4th	M	All	13	24	24	23	29
		S	14	21	8	21	(13)
	F	All	15	27	27	35	33
		S	16	26	18	30	37
Total		All	17	25	23	26	27
Total		S	18	22	14	17	19

TABLE 3 - EXTENDED

$6,300 to $9,000 (5)	$9,000 to $11,500 (6)	$11,500 to $15,000 (7)	$15,000 to $20,000 (8)	$20,000 to $50,000 (9)	Total (10)
23	19	23	20	17	23
19	18	23	20	16	19
19	22	21	16	9	18
22	21	21	16	8	17
23	21	17	16	13	23
17	21	15	16	13	18
25	19	16	16	15	20
22	19	15	16	16	18
26	20	23	13	15	22
22	19	23	13	14	18
25	19	14	17	15	20
23	18	13	17	15	18
29	17	27	24	12	25
19	14	27	24	13	19
26	27	21	22	18	27
(40)	(26)	10	27	17	24
24	20	20	17	14	22
21	19	20	18	14	19

Note. The parentheses indicate that the number of cases in the sample was less than 30.

Source: See Table 1.

Parent Contribution Influence

In order to see if there is, in fact, a difference between the columns or between the rows in Table 3, an F test was applied.[5] The following table shows the F values for the differences in the columns in each row.

TABLE 3e

THE F VALUES AND THE DEGREES OF FREEDOM

Row Number	F Value	Degrees of Freedom
1	5.12	8.616
2	1.59	8.448
3	3.21	8 255
4	3.52	8=218
5	4.76	8=422
6	.88	8=262
7	1.61	8=217
8	.72	8=155
9	2.79	8.343
10	1.34	8=203
11	2.45	8.185
12	2.40	8.134
13	2.35	8.190
14	1.29	7.92
15	1.50	8.105
16	1.33	6.48

Source. Calculated from Table 3.

[5] A one-way analysis of variance was calculated for each row and each column, based on worksheet data. The null hypothesis was that there is no difference between the columns or the rows.

From Table 3a we can see that for all single students except freshman females, parent contribution did not have any effect on the number of weeks worked by the students. The values of F did not exceed the critical point for 99 percent, except for freshman single females (row 4), and in most cases did not exceed the critical point, even for 95 percent.

For "all" students (rows with odd numbers), parent contribution had effect on the weeks worked during the freshman year and for sophomore males, and only slightly for junior males. The conclusions one can draw from Table 3a are:

1. Parent contribution is not a factor for single students in determining how many weeks per year of work.

2. Parent contribution is a factor in determining the amount of work for married students in the first year of college and for married males in the second year as well.*

These results can be seen clearly in Table 3. In the first year the first two columns are greater than the others for "all" students, and each year there is no obvious pattern for "single" students.

*Since in the last two years in college parent contribution had no effect on either single or "all" students, differences between married and singles for these years are meaningless.

Since these results were unexpected, similar tests were made on the students who worked more than 13 weeks a year. Although we could not get information on how those 13 weeks were distributed, it seems reasonable to assume that those 13 weeks are mainly the summer break. The students who worked more than three months definitely worked during the school period and not only during summer breaks. The tests are similar to those made in Table 3a except that here we have excluded the students who worked less than 14 weeks. Table 3b shows the results.

The outcomes in Table 3b not only confirm what was found in Table 3a but show even more support that parent contribution has no influence. The significant levels of F values for single students are greater than 5 percent, and only in row (4) is the significant level slightly lower than 1 percent. For "all" students we can see that F values in each row are smaller in Table 3b than in Table 3a.

The results found in Table 3b are important because one may suggest (with Becker, Schultz, and others) that students go to work during summer break regardless of their economic situation. These results show that parent contribution also has no effect on students who worked

TABLE 3b

THE F VALUES AND THE DEGREES OF FREEDOM

Row Number	F Value	Degrees of Freedom
1	2.256	8.445
2	.533	8.286
3	2.398	8.151
4	2.775	8.121
5	3.757	8.310
6	1.588	8.163
7	1.047	8.136
8	.740	8.88
9	1.324	8.244
10	.981	8.126
11	1.951	8.124
12	2.099	7.79
13	1.701	8.149
14	.658	7.60
15	.952	8.87
16	.431	3.32

Source: Calculated from Table 3 excluding those who worked less than 14 weeks.

more than just during the summer break.

Consequently, we feel confident in saying that parent contribution does not play a noticeable role in a student's decision as to how much time he or she should work during the school year.

Another experiment was made to see the effect of parent contribution on number of weeks worked. Table 4 shows the mean contribution for each different category.

TABLE 3c

THE F VALUES AND THE DEGREES OF FREEDOM

	Contribution Categories								
	No Contribution	$1 to $1,500	$1,500 to $3,800	$3,800 to $6,300	$6,300 to $9,000	$9,000 to $11,500	$11,500 to $15,000	$15,000 to $20,000	$20,000 to $50,000
"All"									
F Value	.790	3.079	3.113	1.366	.821	.488	1.503	.859	1.228
Degrees of Freedom	7.530	7.221	7.215	7.246	7.205	7.228	7.232	7.229	7.227
Single									
F Value	1.026	1.183	.915	1.888	.290	.234	2.003	.870	1.542
Degrees of Freedom	7.377	7.78	7.68	7.88	6.116	6.186	7.214	7.204	7.234

Source: Calculated from Table 3.

TABLE 3d

THE T VALUES AND THE DEGREES OF FREEDOM

Row Numbers	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
T Value	1.[illegible]	.[illegible]	1.[illegible]	.[illegible]	1.[illegible]	.[illegible]	[illegible]	1.0[illegible]
Degrees of Freedom	1080	489	700	388	562	335	298	169

Columns	No Contribution	$1 to $1,500	$1,[illegible]0 to $3,800	$3,800 to $6,300	$[illegible],[illegible]00 to $9,000	$9,000 to $11,500	$11,500 to $15,000	$15,000 to $20,000	$20,000 to $50,000
T Value	3.141	4.734	4.193	5.313	1.956	.800	.263	.044	.195
Degrees of Freedom	921	300	310	348	334	431	455	428	492

Source. Calculated from Table 3

TABLE 4

AVERAGE PARENT CONTRIBUTION,
BY WEEKS WORKED, SEX, MARITAL STATUS, AND YEAR IN COLLEGE

Year in College	Sex	Marital Status	Number of Weeks Worked							
			Did Not Work (1)	1-13 (2)	14-26 (3)	27-39 (4)	40-47 (5)	48-49 (6)	50-52 (7)	Total
1st	Male	All	1							
		Single	2	11,001	12,355	12,457	10,677	12,649	7,162	10,785	11,614
	Female	All	3							
		Single	4	12,633	15,011	14,458	10,270	10,523	8,530	9,083	12,836
2nd	Male	All	5							
		Single	6	10,077	9,522	9,606	9,538	7,852	10,767	5,765	8,976
	Female	All	7							
		Single	8	12,450	11,440	11,260	11,475	10,193	14,314	6,805	10,240
3rd	Male	All	9							
		Single	10	8,129	10,120	7,846	6,070	7,853	8,322	8,737	8,644
	Female	All	11							
		Single	12	17,425	13,155	11,760	10,641	4,300	4,758	9,996	12,301
4th	Male	All	13							
		Single	14	7,592	8,272	7,804	10,635	1,100	(0)	6,658	7,646
	Female	All	15							
		Single	16	8,700	14,047	4,778	6,257	11,083	(100)	3,069	7,756
Total		All	17							
Total		Single	18	11,639	11,830	10,779	9,814	9,356	7,799	8,402	10,661

Note: The parentheses indicate that the number of cases in the sample was less than 3.

Source: See Table 1.

An F test was used to determine if there is a difference between the mean parent contribution in each category of weeks worked. Table 4a illustrates the outcomes.

TABLE 4a

THE F VALUES AND THE DEGREES OF FREEDOM

Row Number	F Value	Degrees of Freedom
1	7.819	6.688
2	1.299	8.516
3	3.448	6.328
4	2.430	6.214
5	8.621	6.478
6	1.090	6.312
7	1.289	6.278
8	.893	6.190
9	1.885	6.393
10	.617	6.234
11	2.408	6.246
12	2.785	6.172
13	1.570	6.208
14	.737	5.106
15	2.497	6.126
16	1.607	5.56

Source: Calculated from Table 4.

When all variables were held constant (lower part of Table 4a), there was no difference in the effect of parent contribution in any row. Note that this also included those who did not work. For "all" students the

results are similar to those found in Table 3a. That is, freshman students and male sophomores were influenced somewhat by their parent contribution.

We did not expect to find identical results, since the population in Table 4 includes more students (those who did not work) than in Table 3. But it was interesting to see that the conclusions are consistent.

Sex and Year in College Influence

In order to see if and how sex and year in college affect the number of weeks worked, similar tests were made to those in the previous section. That is, for each category of parent contribution we wanted to see if there were any differences in the rows, that is, sex and year in college. The F test[7] was used for each category. Table 3c provides the results.

We observe in the above table that for single students, there is no difference in the rows, for each contribution category. That is, for singles, sex and year in college are not factors in determining how many weeks the students worked.

[7] See footnote 5.

For "all" students only in two categories ($1-1,500 and $1,500-3,800) was a difference noticed, even though the F value is barely larger than the critical point. But if we look at Table 3, columns (2) and (3), we see an interesting pattern. Freshman and senior students work more than the sophomore and junior students.

The conclusions drawn from Table 3c are

1. Neither sex nor year in college has an effect on the decision of how many weeks a student works.

2. Sex and year in college have an effect on the number of weeks worked for married students, but only for small contribution groups ($1-1,500 and $1,500-3,800).

Marital Status Influence

It was mentioned earlier that direct information on married students was not available. Hence, any conclusions regarding married students are partly speculative and partly evidential. In order to make the tests meaningful, we assumed that the difference between single students and all students, if such difference occurred, is mainly caused by married students. Under this assumption a T test[3] was used to see if there is any difference

[3]The test was calculated from an analysis of variance table, and it was a two-tail test

between singles and married. The test was made in two ways. First, it was used to find differences between rows, that is, in comparing every two corresponding rows. For example, we tried to see if the values for "all" male freshmen (row 1 in Table 3) are statistically different from the values for single male freshmen (row 2 in Table 3).

The second use was to find the differences in columns. That is, for each column we attempted to determine if any difference exists between the values. For example, in column (1) we compared values for single students with those for "all" students. Table 3d shows the outcomes.

From the upper part of Table 3d we can see that, as far as parent contribution is concerned, marital status among females has no effect on number of weeks worked. For males, marital status has an effect every year in college. Recalling the results from Table 3a, the difference between single and married males in their junior and senior years is not large enough in the sense that for both, parent contribution has no effect on weeks worked.

The lower part of Table 3d indicates that in the small contribution groups there is a significant difference between single and married students. In large

contribution groups there is no such difference. Again, if we recall the results from Table 3o we may conclude that the differences which occurred in the first and fourth categories of contribution are not significant for explaining differences in the number of weeks worked.

However, since the percentage of married students is larger in small contribution groups[3] but smaller among freshmen and sophomores (see Appendix Table A-1, rows 6-7 and columns 8-11), a conclusion that marital status has an effect on number of weeks worked should be accepted with some caution.

Conclusions

The hypothesis presented at the beginning of this chapter was that socio-economic and demographic factors determine and influence the decision of how much time students spend working. This hypothesis was divided into two parts: first, the significance of the variables on the decision whether or not to go to work, and second, the significance of these variables in determining how many weeks per year they participate in the labor force.

[3]This fact was found by comparing the number of cases in each income category

The specific variables which were tested were: sex, year in college, age, marital status, place of birth,[10] and parent contribution. Several tests were conducted to test this hypothesis.[11]

Although the conclusions were drawn independently from the two parts of the hypothesis, we can state them as one conclusion since they are alike. The various tests showed enough evidence to reject the hypothesis. In other words, all the socio-economic and demographic variables tested (with some possible moderate exceptions about marital status) have no influence on students' decisions as to whether or not they go to work and the amount of time they work.

The importance of these findings is that the conventional wisdom has generally accepted the notion that economic and related forces determine student work behavior. There simply is no such empirical evidence. Indeed, on the contrary, such forces do not appear to

[10]The tests concerning age, race, and place of birth were not demonstrated in the text.

[11]More tests were made, such as the Friedman Two-Way Analysis of Variance by Ranks and the Kruskal-Wallis One-Way Analysis of Variance by Ranks. Also, Spearman and Kendall correlation coefficients were calculated. But since those nonparametric tests showed similar results, and since their power is less than F, T, and χ^2 tests, these latter tests were preferred.

play a role, which suggests that other hypotheses, incorporating psychological, social, and personal factors, may be the important influences on the decision to work while a person is in school.

CHAPTER IV

SUMMARY AND CONCLUSIONS

The subject, human capital, has received increasing attention among economists during the past decade. Nevertheless, some shortcomings still prevail in the relevant economic literature. One of these deficiencies refers to student employment. It is particularly important in studies which try to estimate and measure the cost of education. Student employment plays an important role in the investigations of growth, labor force, unemployment, national product and income, distribution of income, and in many other economic research areas.

Our study tries to measure and estimate the amount of student employment and to investigate the importance of socio-economic variables which influence the student's decision to work. In other words, what relevance do such variables have to a student in deciding whether or not to work and the time he wishes to spend in the labor force.

In the first chapter of our study we surveyed the more recent economic literature. We concentrated, mainly,

on the studies conducted in the last decade which try to estimate and measure the cost of higher education. We showed that there are essentially two approaches, investment (or production) and consumption, which economists have attempted to separate and to measure with respect to higher education. We further showed that most of the studies did not attempt to estimate actual student employment but rather assumed an arbitrary number of weeks worked. Empirical studies such as those written by Becker, Schultz, Blitz, and others, assumed that students work during the summer break only and this amount was incorporated in their research. A conclusion one may draw from reading those studies is that the decision whether or not to work did not appear to be rooted in the student's personal characteristics but was exogenous to him. However, there is a conventional belief that socio-economic and demographic variables have influence on students' decision concerning work. In the following chapters we tried to explore this hypothesis.

In the second chapter we built a model showing the relationships between student characteristics and student employment. The model also shows the connection to the foregone income and to the profitability of the investment in education. The main conclusion of the model is

that an abler student could choose to spend less time at school work than the less able student (*ceteris paribus*), and hence the former can spend more time at work. If he does so, he foregoes less income and the profitability of his investment in education is higher.

In the third chapter we examined the model which we developed in the second chapter and tried to remedy the shortcomings mentioned in the first chapter. We concentrated on labor force characteristics of undergraduate students in American colleges and universities. Our source of data was the U. S. Census for 1970.

Our initial finding was that the assumption that students work only during summer break has no empirical evidence. On the contrary, we found that only 14 percent did not work at all and more than 60 percent of the students worked more than 14 weeks, that is, more than just the summer break (see Table 2).

We then attempted to estimate the influence of socio-economic and demographic variables on the student's decision to work. The relevant variables were parents' contribution (income received from parents), sex, age, race, place of birth, year in college, and marital status. We found that none of the above variables has a statistical significance on the amount of weeks worked by students.

The conclusion, therefore, is that the conventional wisdom which holds that socio-economic and demographic variables affect students' decision to work has no empirical support. Hence, we suggest that research which tries to explore this subject should incorporate other variables (such as psychological, social, and environmental) in order to uncover what influences the student in his decisions on how to arrange his time while he is in college, that is, how much time he wants to spend at school work and how much he wishes to participate in the labor force.

APPENDIX

EXCERPTS FROM PUBLIC USE SAMPLES OF BASIC RECORDS FROM THE 1970 CENSUS[1]

Each 1970 public use sample is a representative sample of the records from the 1970 Census sample questionnaires. The primary sample size is one-in-100, or one sample unit (household, vacant unit, or person in group quarters) for every 100 such units in the population. For each household, information is provided about the housing unit itself as well as the characteristics of each person therein. The samples are self-weighting; that is, each person or household is assigned a weight of 100. In order to estimate the frequency of a particular characteristic for the entire population, a user multiplies his tabulations of public use sample records by 100.

No names, addresses, or detailed geographic information appear in the samples in order to avoid identifying any individual or household. Geographic areas identified in public use samples are sufficiently large (250,000 persons or more) to avoid disclosure of information for

[1] U.S. Department of Commerce, Bureau of Census, 1972.

specific individuals.

Two long form Census questionnaires were used in the 1970 Census of Population and Housing: one for a 15 percent sample, the other for a 5 percent sample of the population. Public use samples of 15 percent and 5 percent data are created separately, since the two questionnaire forms contain many different questions. Because the 1/100 sample size represents a fraction of the total population, each 1/100 sample actually contains either one-fifteenth of all 15 percent basic records or one-fifth of all 5 percent basic records, representing slightly over 2 million persons in either case.

Each of the six one-in-100 samples is contained on 30-33 tapes. Each sample is subdivided geographically into a series of convenient units or "files," usually consisting of a single tape, though a few may be as large as six or seven tapes. All sampled records within an identified geographic area are consecutively arranged within a particular file.

Sample Size

Many users will not require a file so large as one-in-100. From each of the six one-in-100 samples is prepared a one-in-1,000 sample (a stratified systematic sub-

sample of 1/10 of the records in the corresponding primary sample) as a three- or four-tape file for the U.S., and a one-in-10,000 sample (a subsample of 1/100 of the corresponding primary sample) as a single tape file for the U.S.

Each of the one-in-100 samples was selected as a stratified subsample of either the 15 percent population sample or the 5 percent population sample. All cases were assigned to the appropriate one of 38 strata. Within each stratum one-fifteenth (for 15 percent data) or one-fifth (for 5 percent data) of the cases were selected to create a particular one-in-100 sample. As each case was selected within a particular stratum it was assigned a subsample number from 00 to 99, recorded on each housing unit record. All sample units with the same subsample number represent a systematic selection of 1/100 of a one-in-100 sample, i.e., a one-in-10,000 sample. A one-in-1,000 sample is obtained by combining ten of these one-in-10,000 samples, by selecting records with the same number in the units digit of the two-digit subsample number. A user may himself select a subsample of any desired size between one-in-100 and one-in-10,000 by using an appropriate combination of the subsample numbers. For instance, a stratified systematic one-in-2,000 sample

could be selected using all sample units with a subsample number of 01, 21, 41, 61, or 81.

Sample Design

For sample data collected in the 1970 Census, the housing unit, including all its occupants, was the sampling unit; for persons in group quarters identified in advance of the Census, it was the person. In nonmail areas (areas in which the respondent was not asked to return his questionnaire by mail), the enumerator canvassed his assigned area and listed all housing units in an address register sequentially in the order in which he first visited the units, whether or not he completed the interview. Every fifth line of the address register was designated as a sample line, and the housing units listed on these lines were included in the sample. Each enumerator was given a random line on which he was to start listing and the order of canvassing was indicated in advance, although the instructions allowed some latitude in the order of visiting addresses. In mail areas, the list of housing units was prepared prior to Census Day either by employing commercial mailing lists corrected through the cooperation of the Post Office or by listing the units in a process similar to that used in nonmail areas. As in nonmail

areas, every fifth housing unit on these lists was designed to be in the sample. In group quarters, all persons were listed and every fifth person was selected for the sample; information on the housing characteristics of group quarters was not collected in the Census.

This 20 percent sample was subdivided into a 15 percent and a 5 percent sample by designating every fourth 20 percent sample unit as a member of the 5 percent sample. The remaining sample units became the 15 percent sample. Two types of sample questionnaires were used, one for the 5 percent and one for the 15 percent sample units. Some questions were included on both the 5 percent and 15 percent sample forms and, therefore, appear for a sample of 20 percent of the units in the Census. Other items appeared on either the 15 percent or the 5 percent questionnaires.

Although the sampling procedure did not automatically insure an exact 20 percent sample of persons or housing units in each locality, the sample design was unbiased if carried through according to instructions; generally for larger areas the deviation from 20 percent was found to be quite small. Biases may have arisen, however, when the enumerator failed to follow his listing and sampling instructions exactly. Quality control procedures were

used throughout the Census process, however, and where there was clear evidence that the sampling procedures were not properly followed, some enumerators' assignments were returned to the field for resampling. Estimates for the United States as a whole indicate that 19.6 percent of the total population and 19.7 percent of the total housing units were enumerated on sample questionnaires.

The computation of these proportions excluded several classes of the population and housing units for which no attempt at sampling was made. These were the relatively small numbers of persons and housing units (in most states, less than 1 percent) added to the enumeration from the post-Census Post Office check, the various supplemental forms, and the special check of vacant units. However, the ratio estimation procedure described below adjusts the sample data to reflect these classes of population and housing units.

The statistics based on 1970 Census sample data are estimates made through the use of ratio estimation procedures which were applied separately for the 5, 15, and 20 percent samples. The first step in carrying through the ratio estimates was to establish the areas within which separate ratios were to be prepared. These are referred to as "weighting areas." For the 15 and 20 per-

cent samples, the weighting areas contained a minimum population size of 2,500. The weighting areas used for the 5 percent ratio estimate were larger areas having a minimum population size of 25,000 and comprising combinations of the weighting areas used for the 15 and 20 percent samples. Weighting areas were established by a mechanical operation on the computer and were defined to conform, as nearly as possible, to areas for which tabulations are produced.

The ratio estimation process for population data operated in three stages. The first stage employed 13 household-type groups (the first of which was empty by definition), the second stage used two groups, head of household and not head of household, and the third stage used 24 age-sex-race groups.

At each stage, for each of the groups, the ratio of the complete count to the weighted sample count of the population in the group was computed and applied to the weight of each sample person in the group. This operation was performed for each of the 13 groups in the first stage, then for the two groups in the second stage, and finally for the 24 groups in the third stage. As a rule, the weighted sample counts within each of the 24 groups in the third stage should agree with the complete counts

for the weighting areas. Close, although not exact, consistency could be expected for the two groups in the second stage and the 19 groups in the first stage.

In order to increase the reliability, a separate ratio was not computed in a group whenever certain criteria pertaining to the complete count of persons and the magnitude of the weight were not met. For example, for the 20 percent sample the complete count of persons in a group had to exceed 85 persons and the ratio of the complete count to the unweighted sample count could not exceed 20. Where these criteria were not met, groups were combined in a specific order until the conditions were met.

Each sample person was assigned an integral weight to avoid the complications involved in rounding in the final tables. If, for example, the final weight for a group was 5.2, one-fifth of the persons in the group (selected at random) were assigned a weight of 6 and the remaining four-fifths a weight of 5.

An analogous procedure of ratio estimation was carried out to assign weights for each housing unit for use in preparing Census publications of housing data. Weights assigned to housing units were not used in selection of households for public use samples, but were used

in the selection of vacant units for the samples. The three groups--year-round vacant for sale, year-round vacant for rent, and other vacant--were separately ratio estimated.

The ratio estimates realize some of the gains in sampling efficiency that would have resulted had the population been stratified into the groups before sampling. The net effect is a reduction in both the sampling error and possible bias of most statistics below what would be obtained by weighting the results of the sample by a uniform factor (e.g., by weighting the 20 percent sample by a uniform factor of 5). The reduction in sampling error will be trivial for some items and substantial for others. A by-product of this estimation procedure is that estimates for this sample are, in general, consistent with the complete count for the population and housing unit groups used in the estimation procedure.

Each of the three one-in-100 samples drawn from 15 percent sample records was created using a systematic selection of, effectively, one-in-15 within each of 75 strata. At the same time three one-in-100 samples were drawn from 5 percent sample records using a systematic selection of, effectively, one-in-five within the same strata for each sample. The strata were defined in terms

of 1970 Census data and, with only minor exceptions, employ the characteristics used to establish the ratio-estimation cells derived in preparing the weights carried on the 5 percent and 15 percent sample records. The selection method was designed to sample cases from each geographic area and stratum in proportion to its frequency in the population. It may be considered a valid proportionate sample for all types of areas or subunits of the population.

The designation of the six one-in-100 (or 1 percent) samples is illustrated by the selection of one of the 1 percent samples from the 15 percent sample Census records. To designate the sample, a set of counters--one for each of the strata--is reserved. Each counter is assigned an initial value or random start number, between 0 and 99.

Each sample unit--household, group quarters (GQ) person, or vacant housing unit--in the original data file is considered in turn. The computer examines the data given on the record and classifies the unit into the proper stratum. The 15 percent sample weight of the unit is added to the existing value in the counter for that stratum. If the unit involved is an occupied unit, the weight assigned to the household head is used for cumulation; if it is a GQ person or a vacant housing unit, the

weight for the GQ person or for the vacant housing unit is cumulated.

A sample unit is selected for the 1 percent sample if the addition of its weight causes the cumulation of weights for the stratum to equal or pass a multiple of 100. When an occupied housing unit is selected, each member of the household, as well as the housing unit itself, becomes part of the public use sample.

Three one-in-100 samples were actually drawn from 15 percent sample records. Thus, three sets of counters were used, one for each sample. For the second sample the random start numbers were incremented by 33 and for the third sample, by 66. The 15 percent weight of each 15 percent sample unit was cumulated in the appropriate stratum for each of the three samples. When the cumulation passed a multiple of 100 in one of the sets of counters that sample unit became part of the associated 1 percent sample. Since no 15 percent weight ever was as large as 34 it was impossible for a single sample unit to be selected into more than one of the 1 percent samples, and thus the samples are mutually exclusive.

The three one-in-100 samples drawn from 5 percent data were selected in exactly the same manner using the 5 percent weights assigned to the sample units. For

practical purposes, these three 1 percent samples may also be considered mutually exclusive, since the probability that a given case will appear in more than one public use sample is less than .001.

TABLE A-1

STUDENT CHARACTERISTICS - SUMMARY

		Sex		Race		Marital Status	
		Male (1)	Female (2)	White (3)	Nonwhite (4)	Single (5)	Married (6)
Total	1	57.8	42.2	92.1	7.9	85.2	14.8
Male	2			58.8	46.6	55.7	70.2
Female	3			41.2	53.4	44.3	29.8
White	4	93.7	90.0			91.9	93.7
Nonwhite	5	6.3	10.0			8.1	6.3
Single	6	82.1	89.6	85.0	88.2		
Married	7	17.9	10.4	15.0	11.8		
1st Year	8	32.4	36.4	33.6	40.4	36.6	19.5
2nd Year	9	29.8	26.5	28.8	24.3	29.2	24.3
3rd Year	10	21.1	21.4	21.1	21.7	19.7	29.8
4th Year	11	16.7	15.7	16.5	13.5	14.5	26.3
New England	12	5.9	6.6	6.6	1.2	6.5	4.5
Mid. Atl.	13	22.1	22.3	23.0	10.7	23.4	15.1
E.N. Central	14	21.2	21.0	21.9	11.2	21.4	19.8
W.N. Central	15	10.3	10.1	10.5	5.6	10.0	11.4
So. Atlantic	16	11.0	10.5	9.8	23.7	10.7	11.6
E.S. Central	17	5.0	5.3	4.4	15.1	4.7	7.6
W.S. Central	18	8.5	8.8	8.1	16.0	8.2	10.9
Mountains	19	4.8	4.3	4.7	3.0	4.3	6.3
Pacific	20	11.3	11.1	11.0	13.6	10.9	12.8
Didn't Work	21	9.8	19.3	12.7	26.4	14.0	
1-13 Weeks	22	28.1	30.7	29.2	27.9	34.7	
14-26 Weeks	23	19.7	17.4	19.1	15.2	20.9	
27-39 Weeks	24	9.5	10.5	9.7	11.9	9.1	
40-47 Weeks	25	7.0	8.1	7.5	6.3	6.9	
48-49 Weeks	26	3.9	3.0	3.6	2.6	3.1	
50-52 Weeks	27	22.0	11.2	18.2	9.7	11.3	
% Unemploy.	28	3.1	2.4	2.6	4.5	2.8	2.9
Never Worked or Armed Forces	29	8.1	13.6	9.3	23.8	11.2	6.2
Professional	30	16.0	11.0	14.0	12.6	11.6	27.1
Clerical	31	19.8	49.6	32.3	32.9	32.7	30.4
Craftsman	32	39.0	5.7	25.7	16.7	25.1	24.3
Farm	33	2.9	.6	2.0	1.2	1.9	1.8
Service	34	14.2	19.6	16.8	12.9	17.5	10.3

TABLE A-1 - EXTENDED

Mean	Year in College				Place of Birth		
Age	1st	2nd	3rd	4th	New Eng.	Mid. Atl.	E.N. Cent.
(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
20.5	34.1	28.4	21.2	16.3	6.2	22.1	21.1
20.8	55.0	60.7	57.5	59.4	55.0	57.4	57.9
20.1	45.0	39.3	42.5	40.6	45.0	42.6	42.1
20.5	90.7	93.3	91.9	93.5	98.7	96.7	96.3
20.6	9.3	6.7	8.1	6.5	1.3	3.3	3.7
20.0	91.6	87.4	79.2	76.1	89.0	89.8	86.0
23.6	8.4	12.6	20.8	23.9	11.0	10.2	14.0
19.2					34.0	31.5	34.9
20.4					27.3	31.1	27.9
21.4					20.7	21.3	21.0
22.2					18.0	16.1	16.2
20.5	6.1	5.9	6.2	6.8			
20.3	20.4	23.9	22.8	21.7			
20.5	21.6	20.5	21.3	21.1			
20.4	11.1	8.5	11.0	10.3			
20.4	10.8	11.1	10.1	10.9			
20.8	4.9	4.7	5.5	6.1			
20.7	8.8	8.8	8.5	8.2			
20.6	5.3	4.3	3.6	4.9			
20.7	11.0	12.3	11.0	10.0			
20.3	13.3	13.7	15.3	11.1	12.6	13.8	8.6
19.6	32.8	29.4	27.2	18.4	31.8	34.8	30.5
19.9	18.5	19.6	19.5	16.1	22.0	18.6	19.1
20.7	8.2	9.6	10.6	15.3	9.9	8.2	10.9
20.7	7.5	7.4	5.9	10.9	4.9	5.4	8.8
20.7	3.5	3.2	4.2	2.8	3.6	3.3	3.8
22.3	16.2	17.1	17.2	25.4	15.2	15.9	18.3
20.6	3.5	2.2	1.9	3.4	1.7	2.0	3.7
20.0	14.0	9.3	8.1	7.9	6.0	10.9	7.5
21.9	7.6	19.1	19.1	24.5	14.7	13.6	13.6
20.3	31.1	31.7	31.7	33.8	32.4	35.8	33.3
20.4	27.4	22.8	22.8	18.0	23.7	22.5	26.9
19.6	2.3	1.4	1.4	1.5	.7	.6	1.7
20.2	17.7	16.9	16.5	14.4	22.4	16.7	17.1

TABLE A-1 - CONTINUED

Place of Birth - Continued						
W.N. Cent. (15)	So. Atl. (16)	E.S. Cent. (17)	W.S. Cent. (18)	Mount. (19)	Pacific (20)
10.2	10.8	5.2	8.6	4.6	11.2
54.0	58.6	56.2	56.7	60.1	58.1
42.0	41.4	43.8	43.3	39.9	41.9
96.2	84.7	79.4	87.1	95.5	91.5
3.8	15.3	20.6	12.9	4.5	8.5
83.2	84.0	78.1	81.1	79.4	82.9
16.8	16.0	21.9	18.9	20.6	17.1
37.2	34.3	32.7	34.4	39.5	33.6
24.0	25.8	26.3	29.4	26.9	31.5
22.4	19.5	21.9	20.6	16.1	20.4
16.4	16.4	19.1	15.6	17.5	14.5
10.3	16.9	26.4	20.8	14.4	8.7
23.8	31.5	23.0	22.1	21.9	25.4
19.6	19.3	15.7	16.4	21.9	18.8
12.3	8.1	9.0	9.7	10.3	12.8
9.4	6.0	6.7	5.4	9.6	11.1
4.7	2.9	2.8	3.0	2.7	3.6
19.9	15.4	16.3	22.5	19.2	19.6
2.2	1.3	2.0	4.5	2.7	4.0
6.5	12.6	21.1	15.7	8.6	7.4
13.7	16.0	15.5	14.0	12.6	12.2
30.1	32.8	28.3	31.8	32.9	31.7
24.8	23.7	27.9	23.4	27.9	27.1
4.8	1.5	.4	3.9	2.3	2.6
20.0	13.4	6.8	11.3	15.8	19.0

TABLE A-1 - CONTINUED

Number of Weeks Worked							
Didn't Work (21)	1-13 (22)	14-26 (23)	27-39 (24)	40-47 (25)	48-49 (26)	50-52 (27)	% Unemploy. (28)
14.0	24.5	16.6	10.0	7.8	4.0	22.9	2.8
43.0	57.5	62.7	57.2	56.3	65.9	74.4	63.3
57.0	42.5	37.3	42.8	43.7	34.1	25.6	36.7
86.8	93.5	94.5	91.8	94.2	94.9	96.2	87.3
3.2	6.5	5.5	8.2	5.8	5.1	3.8	12.7
							84.7
							15.3
38.0	43.8	38.3	32.5	39.2	38.4	35.8	43.3
29.1	29.2	30.2	28.4	28.7	26.8	28.2	22.0
25.0	20.8	23.1	24.0	17.7	26.8	21.8	14.7
8.0	6.2	8.4	15.2	14.3	8.0	14.2	20.0
6.0	6.9	7.3	6.2	4.2	6.5	5.4	3.7
23.8	27.6	22.5	18.8	16.7	22.0	20.4	15.7
13.6	22.0	21.2	22.8	24.7	22.8	21.6	28.4
7.4	7.9	10.0	11.8	12.2	13.0	10.8	8.2
13.8	11.8	11.0	8.7	8.7	8.8	9.4	5.2
10.0	4.0	4.2	4.5	4.6	4.1	4.6	3.7
13.2	6.4	7.3	8.1	6.1	7.3	10.6	14.2
4.5	3.1	4.8	4.2	5.3	3.3	4.4	4.5
7.7	10.2	11.6	14.9	17.5	12.2	12.8	16.4

11.8	13.4	17.0	19.0	19.8	21.8	
33.8	36.1	38.0	36.3	41.2	34.9	
30.8	28.2	23.8	26.3	24.9	25.3	
2.8	2.5	2.1	1.1	.6	1.5	
20.6	19.3	18.3	5.9	13.0	13.5	

TABLE A-1 - CONTINUED

Never Worked or Armed Forces (29)	Occupations: Profes-sional (30)	Clerical (31)	Crafts-man (32)	Farm (33)	Service (34)
10.4	13.8	32.3	24.3	1.9	16.4
45.2	66.7	35.4	90.5	86.4	49.9
54.8	33.3	64.6	9.5	13.6	50.1
82.1	92.9	92.1	94.8	95.1	93.9
17.9	7.1	7.9	5.2	4.9	6.1
91.2	71.1	86.1	85.6	86.4	80.7
8.8	28.9	13.9	14.4	13.6	9.3
45.7	18.7	32.7	37.4	40.8	36.5
25.5	23.4	29.6	31.5	31.1	27.6
16.4	29.3	20.8	19.4	15.5	21.7
12.3	28.4	17.0	11.7	12.6	14.2
3.7	6.5	6.1	5.9	2.2	8.5
24.0	21.7	24.1	20.0	6.5	22.6
15.8	20.7	21.4	22.8	18.3	22.1
6.6	10.1	9.4	10.1	25.8	12.5
13.6	12.5	10.8	10.2	8.6	8.8
10.9	5.8	4.5	5.8	1.1	2.1
13.3	8.6	8.3	8.0	17.2	5.9
3.9	4.2	4.6	5.1	5.4	4.4
8.2	3.8	10.8	12.1	15.1	13.0
	26.0	32.0	37.8	44.7	38.3
	18.1	20.9	21.3	24.3	22.0
	11.7	11.2	9.1	10.7	10.6
	9.1	7.5	7.0	3.9	6.4
	4.7	4.2	3.3	1.0	2.6
	24.7	16.9	15.9	12.6	12.9

TABLE A-1 - CONTINUED

Mean Family Income (35)	Mean Personal Income (36)	Mean Parent Contrib. (37)	Mean Wage Salary (38)
11,238	2,217	8,558	1,995
10,758	3,127	7,583	2,501
12,092	1,746	10,297	1,247
11,430	2,673	8,710	2,024
8,571	2,048	6,474	1,603
12,421	2,349	10,294	1,755
10,496	2,635	7,812	1,917
10,308	2,408	7,849	1,879
10,333	3,869	6,415	3,442
12,247	2,881	9,517	1,933
12,921	2,477	10,395	1,945
12,250	2,841	9,361	2,220
10,384	2,706	7,629	1,990
11,232	2,725	8,457	1,908
8,604	2,448	6,107	1,713
8,741	2,457	6,234	1,848
9,719	2,683	6,988	2,119
10,782	2,657	8,076	2,163
		10,093	
		10,948	923
		9,410	1,584
		7,745	2,297
		7,910	2,850
		6,070	3,269
		5,448	5,011
		10,470	411
		7,134	3,324
		9,769	1,738
		8,104	2,135
		3,904	1,044
		8,391	1,413

Source: U.S. 1970 Census - raw data.

TABLE 1-A

Notes

1. The values in column 7 are years.
2. The values in columns 35-38 are U.S. dollars.
3. The values in other columns are percents.
4. The sum of the rows in each column (except columns 7 and 35-38) for each category is 100.0, e.g., the sum of the rows 8-11 for each column is 100.0. Hence, the value in row 8 and column 5 means that 36.6 percent of all the single students were freshmen.
5. In order to transform the percents to absolute values, one should multiply the first row by 6,875,000 and then multiply the rest of the values accordingly.

SELECTED BIBLIOGRAPHY

Arrow, K. J. "Higher Education as a Filter." J. Public Econ. 2 (July 1973): 193-216.

Rehenfelter, O., and Mooney, J. D. "Graduate Education, Ability and Earnings." Rev. Econ. and Statis. 50 (February 1968): 78-86.

Bailey, D., and Schotta, C. "Private and Social Rates of Return to Education of Academicians." A. E. R. 62 (March 1972): 19-31.

Barzel, Y. "Private Schools and Public Schools Finance." J. P. E. 81 (January 1973): 174-86.

Becker, G. S. "Human Capital: A Theoretical Analysis." J. P. E. 70 (October 1962): 9-49.

_____. Human Capital. New York: Columbia Univ. Press, 1964.

_____. Human Capital and the Personal Distribution of Income: An Analytical Approach. New York: National Bureau of Economic Research, 1966.

Becker, G. S., and Chiswick, B. "Education and Distribution of Earnings." A. E. R. 56 (May 1966): 358-69).

Ben Porath, Y. "The Production of Human Capital Over Time" in Education, Income and Human Capital, edited by W. L. Hansen, pp. 129-47. New York: National Bureau of Economic Research, 1970.

Benson, C. S. The Economics of Public Education. Boston: Houghton Mifflin, 1968.

Blitz, R. C. "The Nation's Educational Outlay" in Economics of Higher Education, edited by S. S. Mushkin, pp. 147-69 and pp. 390-403. Washington. U. S. Dept. of Health, Education and Welfare, 1961.

Bowman, M. J. "Social Return to Education." International Soc. Sci. J. 14 (Fourth 1962): 647-59.

Campbell, R., and Siegel, B. N. "Demand for Higher Education in the United States." A. E. R. 57 (June 1967): 482-94.

Canoro, R. (ed.) Intelligence. New York: Gruna and Stratton, 1971.

Chamberlain, G., and Griliches, Z. "Return to Schooling of Brothers and Ability as an Unobservable

Variance Component." Discussion Paper. 340 Harvard Univ. (February 1974)

Cochrane, J. L., and Riker, E. F. "An 'Austrian' Approach to the Theory of Investment in Human Beings." Southern Econ. J. 32 (April 1970): 385-88.

Cohn, E. "Investment Criteria and the Ranking of Educational Investments." Public Finance 27 (1972): 355-60.

_____. "On the Net Present Value Rule for Educational Investments." J. P. E. 80 (March/April 1972): 418-20.

Conlisk, J. 'A Bit of Evidence on Income-Education-Ability Interrelation." J. Human Resources 6 (Summer 1971). 358-62.

Corozzini, A. J., Dugan, D. J., and Grabowski, H. G. "Determinants and Distributional Aspects of Enrollments in U. S. Higher Education." J. Human Resources 7 (Winter 1972): 39-59.

Crean, J. F. "Expected Rates of Return and the Demand for Education: Some Empirical Evidence." Industrial Relations 27 (August 1972): 382-402.

Daniere, A. "The Economics of Higher Education." Ann. Amer. Acad. Polit. Soc. Sci. 404 (November 1972): 58-70.

Dodge, D. A. and Stager, D. A. "Economic Returns to Graduate Study in Science, Engineers and Business." Canadian J. Econ. 5 (May 1972): 182-98.

Duncan, B. "Dropouts and the Unemployed." J. P. E. 73 (April 1965): 121-34.

Eckaus, R. S. "Returns to Education with Standardized Incomes." Q. J. E. 87 (February 1973): 121-31.

Fama, E. F., and Miller, M. H. The Theory of Finance. New York: Holt, Rinehart and Winston, 1972.

Fields, C. R., and LeMay, M. L. "Students Financial Aid: Effects on Educational Decisions and Academic Achievement." Biblio. J. Col. Stud. Personnel 14 (Summer 1973). 425-29.

Freeman, R. B. The Market for College-Trained Manpower. Cambridge, Mass.: Harvard Univ. Press, 1971.

Friedman, M. "The Higher Schooling in America." Public Interest 11 (Spring 1968): 108-12.

Galper, H., and Dunn, R. M. 'A Short-Run Demand Function for Higher Education in the U. S." J. P. E. 77 (September/October 1969): 765-77.

Goulden, G. H. Methods of Statistical Analysis. New York: John Wiley and Sons, Inc., 1939

Griffin, J. B. "A Cost-Benefit Study of Educational Expenditures." J. Econ. Issues 5 (September 1971): 104-10.

Griliches, Z., and Mason, W. M. "Education, Income and Ability." J. P. E. 80, part II (May/June 1972) 74-103.

Guilford, J. P. Fundamental Statistics in Psychology and Education. New York: McGraw-Hill, 1956.

Gustman, A. L., and Stafford, F. P. "Income Expectations and the Consumption of Graduate Students." J. P. E. 80 (November/December 1972) 1246-58.

Guatman, A. L., and Fidot, G. M. "Interactions Between Educational Spending and Student Enrollment." J. Human Resources 8 (January 1973). 3-23.

Haley, W. J. "Human Capital: The Choice Between Investment and Income." A. E. R. 63 (September 1973) 482-86.

Hanoch, G. "An Economic Analysis of Earnings and Schooling." J. Human Resources 2 (Summer 1967): 310-29.

Hanaan, W. L. (ed.) Education, Income and Human Capital. New York: National Bureau of Economic Research, 1970.

Hansen, W. L., and Weisbrod, B. A. Benefits, Costs and Finance of Public Higher Education. Chicago: Markham, 1969.

Hartman, R. W. "Equity Implications of State Tuition Policy and Student Loans." J. P. E. 80, part II (May/June 1972): 142-71.

Hartman, R. W., and Reischauer, R. D. Reforming School Finance. Washington: Brookings Institute, 1973

Hause, J. C. "Earnings Profile: Ability and Schooling." J. P. E. 80, part II (May/June 1972): 108-38.

Hirsch, W. Z. "Income Elasticity of Public Education." Inter. Econ. Rev. 2 (September 1961): 330-39.

Hoffer, S. W. "Private Rates of Return to Higher Education for Women." Rev. Econ. and Statis. 55 (November 1973): 482-86.

Joint Economic Committee. The Economics and Financing of Higher Education in the United States. Washington: Government Printing Office, 1969

Kendall, M. G. The Advanced Theory of Statistics. London: Charles Griffin and Company Ltd., 1945.

Kiker, B. F. (ed.) Investment in Human Capital. Columbia, S. C.: Univ. of South Carolina Press, 1971.

Lindsay, C. M. "Measuring Human Capital Returns." J. P. E. 79 (December 1971): 1195-215.

Lydall, H. The Structure of Earnings. New York: Oxford University Press, 1968.

Machlup, F. The Production and Distribution of Knowledge in the United States. Princeton, N. J.: Princeton Univ. Press, 1962

Michael, R. T. "Education in Nonmarket Production." J. P. E. 81 (March/April 1973): 306-27.

Mood, A. Mc. Introduction to the Theory of Statistics. New York: McGraw-Hill, 1950.

Mosteller, F., and Moynihan, D. P. (eds.) On Equity of Education Opportunity. New York: Vintage Books, 1972.

Mushkin, S. (ed.) The Economics of High Education. Washington: U. S. Dept. of Health, Education and Welfare, 1961.

Nerlove, M. "On Tuition and Cost of Higher Education: Prolegomena to a Conceptual Framework." J. P. E. 80, part II (May/June 1972): 178-218.

Orwig, M. D. (ed.) Financing Higher Education: Alternatives for the Federal Government. Iowa City: American College Testing Program, 1971.

Owen, J. D. "The Economics of College Scholarships Policy." Social Resources 39 (Spring 1972): 53-69.

Parsons, D. O. "The Cost of School Time, Foregone Earnings and Human Capital Formation." J. P. E. 82 (March/April 1974): 251-66.

Peltzman, S. "The Effect of Government Subsidies-in-Kind on Higher Education." J. P. E. 81 (January 1973): 1-22.

Perl, L. J. "Family Background, Secondary School Expenditures and Student Ability." J. Human Resources 8 (Spring 1973): 156-80.

Popp, D. O. "Human Capital Formation by Expenditure on Education, 1950-60." Q. Rev. Econ. Bus. 12 (Winter 1972): 19-38.

Razin, A. "Optimum Investment in Human Capital." Rev. Econ. Studies 39 (October 1972): 455-60.

Reiss, A. J., Duncan, O. D., Hatt, P. K., and North, C. C. (eds.) Occupational and Social Status. New York: Free Press of Glencoe, 1962.

Robinson, A. J. "Government Subsidy to Higher Education: Benefits, Costs, and Noneconomic Value of the Policy." Amer. J. Econ. Soc. 30 (July 1971): 259-74.

Rosenfeld, C., and Gover, K. "Employment of School-Age Youth." Monthly Labor Rev. 95 (August 1972): 25-30.

Schultz, T. W. The Economic Value of Education. New York: Columbia Univ. Press, 1963.

_____. "Capital Formation by Education." J. P. E. 68 (December 1960): 571-83.

_____. Investment in Human Capital. New York: The Free Press, 1971.

_____ (ed.) Investment in Education. Chicago: Univ. of Chicago Press, 1972.

Schweitzer, S. O. "Occupational Choice, High School Graduation and Investment in Human Capital." J. Human Resources 6 (Summer 1971): 321-32.

Seigel, S. Nonparametric Statistics. New York: McGraw-Hill, 1956.

Solomon, L. C. "Capital Formation by Expenditures on Education in 1960." J. P. E. 79 (December 1971) 1412-417.

Spiegelman, R. G. "A Benefit-Cost Model to Evaluate Educational Programs." Socio-Economics Planning Science 1 (August 1968): 443-60.

Stanfield, J. D. "Socio-Economic Status as Related to Aptitute Attributon and Achievements of College Students." Biblio. Soc. Educ. 46 (Fall 1973). 480-88.

Taubman, P. J., and Wales, T. J. "Higher Education Mental Ability and Screening." J. P. E. 81 (January 1973) 28-55.

Thurow, L. C. "Comment" in Education, Income and Human Capital, edited by W. L. Hansen, pp. 151-54. New York: Nat. Bureau of Econ. Resea., 1970.

Tinbergen, J. "The Impact of Education on Income Distribution." Rev. Income and Wealth 18 (September 1972): 255-65.

Tolley, G. S., and Olson, E. 'The Interdependence Between Income and Education." J. P. E. 79 (May/June 1971). 460-80.

Vaisey, J. E. The Economics of Education. London: Faber and Faber, 1962.

_____. The Political Economy of Education. London: Duckworth, 1972.

Weisbrod, B., and Karpoff, P. "Monetary Returns to College Education, Student Ability and College Quality." Rev. Econ. and Statis. 50 (November 1968): 491-97.

Weiss, Y. "Investment in Graduate Education." A. E. R. 61 (December 1971): 833-52.

_____. "The Risk Element in Occupational and Educational Choices." J. P. E. 80 (November/December 1972): 1203-213.

Wykstra, R. A. (ed.) Education and the Economics of Human Capital. New York: The Free Press, 1971.

BIOGRAPHICAL SKETCH

Yuval Rabinovitch was born on August 18, 1945, in Kibbutz Ruhama, Israel. He was reared in this Kibbutz and attended both elementary and high schools there. During his high school years he belonged to the Youth Movement, Hashomer Hatzair, and was a counsellor of this movement for three years. After completion of high school in 1963, he joined the Israeli Army. After two and one-half years of service he returned to the Kibbutz Ruhama. There he worked approximately one year in agriculture and then taught science, mathematics, chemistry, and physics at the high school in the Kibbutz for two years. He left the Kibbutz in 1968 to attend Hebrew University in Jerusalem. He received the Bachelor's Degree in economics and political science in July, 1971. During the last year in his studies at Hebrew University he worked for Professor Haim Barkai at the Falk Institute for Economic Research in Israel. After completing his Bachelor's Degree at Hebrew University he applied and was accepted to attend the Graduate School in the Department

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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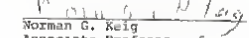

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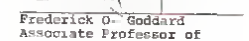

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